

**STANDARD SPECIFICATIONS FOR THE PURCHASE OF CARBON-FILAMENT
INCANDESCENT LAMPS**

Department of Commerce and Labor
BUREAU OF STANDARDS
Washington

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An informal conference called by the engineers of the various Government Departments and attended by them, by representatives of the manufacturers of incandescent lamps in the United States, and by representatives of the Bureau of Standards and the Electrical Testing Laboratories, was held in Washington February 25 to 27, 1907, at which the following specifications for the purchase of electric incandescent lamps were adopted.

Although these specifications were written primarily with the view that they would be recommended to the Departments of the Government, to be used by them in purchasing their annual supplies of incandescent lamps, it seemed desirable, both on account of the representative character of the conference and the thoroughness with which the subject was discussed, that the results of the conference should be available for the general public.

The Bureau of Standards indorses these specifications and has therefore undertaken to publish them for distribution. In circulating them freely, however, it desires to call attention to the necessity of extreme caution in the application of the tests described in the specifications. Only those thoroughly instructed in the art of lamp manufacture and in the science of photometry should undertake to determine upon the acceptability of lamps under the terms of the specifications.

11-712

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Director.

SPECIFICATIONS FOR CARBON-FILAMENT ELECTRIC LAMPS.

1. SAMPLES.

To show construction, bidders must, if requested, submit two samples of each type of lamp proposed to be furnished. All lamps must conform to the samples submitted, in shape of bulb, mechanical construction, and type of filament, and no departure from the sample lamps will be permitted without the written consent of _____.

(Name of purchaser.)

2. COMPARATIVE TESTS.

In determining the award of a contract _____ may require
 bidders to submit for a comparative test 500 lamps. Such test will be conducted with a procedure similar to that outlined in these specifications for inspection and tests of lamps ordered under contract, modified as follows:

(1) Inspection of 50 per cent of each lot of 500 lamps to discover faults in construction and sorting.

(2) Determination of the uniformity, or nonuniformity, of rating, and the characteristics of the distribution of light of the lamp, including the measurement of about 100 lamps of each lot of 500 to determine the mean horizontal, tip, and mean spherical candle-power, together with the current consumption.

(3) Determination of mean spherical candlepower performance throughout the useful life of 25 lamps of each lot of 500 submitted, operated at voltages corresponding to an initial specific consumption of 3 watts per mean spherical candle.

3. STANDARD INCANDESCENT LAMPS.

Incandescent lamps to be furnished under this contract shall be new lamps and shall be guaranteed to be in accordance with the following specifications:

4. GENERAL CONDITIONS.

The provisions of these specifications shall be binding upon all lamps specifically mentioned herein, or in schedules, by voltage, candlepower, watts per candle, type, and base, and upon no other lamps, except by mutual written agreement.

These specifications shall not apply to any frosted, colored, or other lamps than with the usual clear-glass bulbs, unless otherwise specifically included. Frosted lamps shall be represented in initial tests, inspection, and life tests by bare lamps selected from the lots before frosting.

All tests shall be made in a competent and expert engineering manner at the expense of _____, excepting that when initial inspection and tests are made

(Name of purchaser.)

at the factory the contractor will be required to supply the necessary equipment, assistance, current, and facility for making the tests. The manufacturer, or his agent, shall have the privilege of witnessing and verifying all tests of his lamps made hereunder, and shall also be privileged to obtain copies of the tests of his lamps and have access to the records of such tests at all reasonable times.

With the consent of the contractor, the method of test procedure may be modified in any particular, whenever such change is desirable to secure test results in a more practicable, representative, or accurate manner.

5. DEFINITIONS AND STANDARDS.

Unit of candlepower.—The unit of candlepower shall be the candle as determined by the Bureau of Standards at Washington, D. C.

Photometric measure.—The basis of comparison of all lamps shall be the mean spherical candlepower. The nominal candlepower referred to in these specifications shall be the mean horizontal candlepower of lamps having a mean spherical candlepower value of 82.5 per cent of the mean horizontal candlepower, which is the standard value for filaments of the oval anchored type.

For lamps having filaments giving a different ratio of mean spherical to mean horizontal candlepower, the horizontal candlepower measurement will be corrected by a reduction factor determined by the Bureau of Standards or other authority mutually agreed upon.

Test quantity.—The test quantity shall consist of 10 per cent or more of any lot or package, and in no case shall be less than 10 lamps.

6. METHOD OF TEST.

From each package there will be selected at random the test quantity for the purpose of determining the mechanical and physical characteristics of the lamps, the individual limits of candlepower and watts, and finally the life and candlepower maintenance. These lamps will be known as the test lamps.

7. MECHANICAL AND PHYSICAL CHARACTERISTICS.

All lamps shall conform to the manufacturer's standard shapes and sizes of bulbs, and to the standard forms of filament, and the standard candlepower and watts ratings.

8. BULBS.

All bulbs shall be uniform in size and shape, clear, clean, and free from flaws and blemishes.

9. BASES.

All lamps, unless otherwise specified, shall be made with moisture-proof standard Edison screw bases, fitted with glass buttons. The shells of the bases shall be of good quality brass, firmly and accurately fitted to the bulb with moisture-proof cement, and in length to conform to the Electric Code of the National Board of Fire Underwriters.

10. FILAMENTS.

The lamp filament must be symmetrically disposed in the bulb and shall not droop excessively during the life of the lamp, when the lamp is burned on test in one horizontal position at a voltage corresponding to an initial specific consumption of 3.76 watts per mean spherical candle.

All filaments must be uniform and free from imperfections, spots, and discolorations.

11. LEADING-IN WIRES.

Leading-in wires must be fused into the glass with the joints between the copper and platinum wires bedded well within the glass, and must be straight, well separated, and securely soldered to the base and cap, without excess of solder. The threads of the base must be free from solder.

12. VACUUM.

All lamps must have first-class vacuum, showing the characteristic glow of good vacuum when tested on an induction coil.

13. MARKING.

A printed label, showing manufacturer's name or trade-mark, voltage, and candle-power, must be placed on each lamp near base.

14. IN GENERAL.

The lamps must be well made and free from all defects and imperfections, so as satisfactorily to meet the conditions of the lighting service.

15. REJECTION FOR DEFECTS.

If 10 per cent of the test quantity of lamps selected from any package show any physical defects incompatible with good workmanship, good service, or with any clause of these specifications, the entire lot from which these lamps were selected may be rejected without further test when tests are made at the lamp factory. When the tests are made elsewhere, if the first test quantity proves unacceptable, 20 per cent more lamps will be selected from the package or lot of lamps, and should 10 per cent of this second lot of sample lamps be found to have any of the physical defects above mentioned, the entire lot from which these samples were selected may be rejected without further test.

16. INITIAL LIMITS.

When tested at rated voltage, the test lamps shall not exceed the limits given in schedule. If 10 per cent of the test lamps from any package is found to fall beyond the limits stated, when tests are made at the lamp factory, the entire lot from which these lamps were selected may be rejected without further test. When tests are made elsewhere, if the first test quantity proves unacceptable, 20 per cent more lamps will be selected from the package or lot of lamps, and should 10 per cent of these additional lamps be found to fall beyond the limits, the entire package may be rejected without further test.

17. LIFE AND CANDLEPOWER MAINTENANCE.

Life tests shall be made as follows: From each accepted package of lamps, two sample lamps shall be selected which approximate most closely to the average of the *test quantity*. One of the two lamps thus selected will be subjected to a life test and designated as the *life-test lamp*, the second or duplicate lamp being reserved to replace this *test lamp* in case

of accidental breakage or damage during the life test. The *test lamps* shall be operated for candlepower performance at constant potential, average variations of voltage not to exceed one-fourth of 1 per cent, either side.

The voltage for each lamp shall be that corresponding to an initial specific consumption of 3.76 watts per mean spherical candle, or if tested upon a different basis, the results shall be corrected to a basis of 3.76 watts per mean spherical candle. If desired, the life tests may be made at such other watts per candle as may be mutually agreed upon.

Readings for candlepower and wattage shall be taken during life at the marked voltage of the lamps at approximately fifty hours, and at least every one hundred hours afterwards until the candlepower shall have fallen 20 per cent below the initial candlepower, or until the lamp breaks, if within that period. The number of hours the lamp burns until the candlepower has decreased to 80 per cent of its initial value, or until the lamp breaks, if within that period, is known as the usual or effective life.

The average candlepower of lamps during life shall not be less than 91 per cent of their initial candlepower. In computing the results of test of a lot of lamps the average candlepower during life shall be taken as the arithmetical mean of the values for the individual lamps of the lot tested.

Lamps selected for the life test, which for any reason do not start on such test, shall be replaced by others.

Lamps which are accidentally broken but not burned out on test shall not be counted to diminish the average performance.

In case both test and duplicate lamps are broken or damaged before the life test is completed, the average performance of all lamps of the same class previously tested under the same contract shall be assigned to the package represented.

On all tests for determining average candlepower and life each package which will be affected by the results of test shall have at least one lamp on such test.

Accurate recording voltmeter records will be obtained during the test on lamps to show the average variation on the circuit.

When so tested the average useful life values of the lamps shall be at least as great as those given in the following tables.

(a) VALUES FOR OVAL ANCHORED PLAIN STANDARD LIGHTING LAMPS.

Lamps of this type, of voltages 105 and below, 110, 120, and above, and also 220, may have double the limits of variation in the initial limits specified for their respective classes.

For lamps between 120 and 125 volts the useful life values shall be 95 per cent of those given in the table, and for lamps between 126 and 130 volts the useful life values shall be 90 per cent of those given in the table.

Lamps of other types of filaments shall give equivalent performances.

For 100-130 Volt Lamps.*

RATING.		INITIAL LIMITS.				AVERAGE PERFORMANCE.
Rated candlepower, mean horizontal.	Initial watts per mean horizontal candle.	Individual candlepower limits.	Mean candlepower limits.	Individual watts limits.	Mean watts limits.	Useful or effective life in hours to 20 per cent drop in candlepower at 3.1 watts per candle.
4	4.8	1 c. p. above and 1 c. p. below.	0.6 c. p. above and 0.6 c. p. below.	12 per cent above and 12 per cent below.	6 per cent above and 6 per cent below.	300
5	4.2	do	do	do	do	300
6	3.7	do	do	do	do	300
8	{ 3.1 3.6	do	do	{ 10 per cent above and 10 per cent below.	{ 5 per cent above and 5 per cent below.	{ 300 330
10	{ 3.1 3.6	do	do	do	do	330
12½	{ 3.1 3.6	do	do	do	do	390
16	{ 3.1 3.5	{ $\frac{1}{2}$ per cent above and $\frac{1}{2}$ per cent below.	{ $\frac{1}{2}$ per cent above and $\frac{1}{2}$ per cent below.	{ 5.5 per cent above and 5.5 per cent below.	{ $\frac{1}{2}$ per cent above and $\frac{1}{2}$ per cent below.	{ 450 420
20	{ 3.05 3.5	do	do	do	do	420
24	3.1	do	do	do	do	350
25	3.6	do	do	do	do	350
32	{ 3.1 3.6	do	do	do	do	430
50	3.6	do	do	do	do	430
75	3.6	do	do	do	do	400
100	3.6	do	do	do	do	300

For 200-250 Volt Lamps.

8	4.4	2 c. p. above and 2 c. p. below.	1 c. p. above and 1 c. p. below.	{ 15 per cent above and 15 per cent below.	{ $\frac{1}{2}$ per cent above and $\frac{1}{2}$ per cent below.	120
10	4.25	do	do	do	do	130
16	3.8	15 per cent above and 15 per cent below.	$\frac{1}{2}$ per cent above and $\frac{1}{2}$ per cent below.	12 per cent above and 12 per cent below.	6 per cent above and 6 per cent below.	160
20	3.8	do	do	do	do	160
24	3.8	do	do	do	do	150
32	3.8	do	do	do	do	150
50	3.8	do	do	do	do	120

*It is recommended that every effort be made to avoid ordering lamps of actual rated voltages 105 and below, 109, 110, and 111, 120 and above, and from 218 to 222, inclusive.

(b) VALUES FOR ROUND-BULB, TUBULAR, AND OTHER IRREGULAR TYPES OF LAMPS.

The individual limits for irregular types of lamps, such as round-bulb and tubular lamps, shall be twice the individual limits given in the body of the preceding schedules for regular lamps of corresponding candlepowers.

The individual limits for metallized filament and round-bulb prismo types of lamps shall be 15 per cent above and 15 per cent below the mean candlepower rating, and 15 per cent above and 15 per cent below the mean total watts rating. The candlepower ratings referred to are the mean horizontal candlepower ratings of clear lamps without reflectors.

18. REJECTIONS AND PENALTIES.

The failure of the lamps in any package to conform to the specifications as to mechanical and physical characteristics, or to initial limits, may cause the rejection of the entire package.

The failure of the lamps to give within 90 per cent of the values of useful life given in the tables may cause the cancellation of the contract.

Lamps which have not been used and are rejected under the terms of these specifications will be returned to the manufacturer at his expense, and no payment will be made therefor.

Prompt notice will be served upon the contractor of the test results on lamps that are rejected, or that fail to meet the specified requirements.

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